PATENT SPECIFICATION

(11) 1 228 319

NO DRAWINGS

1 228 319

(21) Application No. 30026/69 (22) Filed 13 June 1969
(31) Convention Application No. P 17 52 612.4
(32) Filed 21 June 1968 in
(33) Germany (DT)
(45) Complete Specification published 15 April 1971
(51) International Classification B 24 d 7/02
(52) Index at acceptance
B3D 2G3D 2G3E 2G3FX
C4V X

(54) IMPROVEMENTS IN OR RELATING TO AN ABRASIVE MEMBER

(71) We, HEINRICH LIPPERT KG, of 4—6 Merianstrasse, Pforzheim, Germany, a Kommanditgesellschaft organised and existing under the laws of the Federal German Republic, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an abrasive member having the shape of, for example, a ring, pot or segment, which abrasive member is elastic and may be applied and bonded to a rigid or flexible support, if desired.

Rigid abrasive members are known, which are bonded with ceramic material, magnesite, hard rubber, natural resin, or plastics material. For certain abrading operations, elastic abrasive members are used, particularly for work on profiled members, e.g., in the manufacture of fittings and cutlery, in the manufacture of household goods, chemical equipment, hardware for use in buildings, and parts of motor vehicles.

The previously used elastic abrasive members include discs (so-called felt wheels), which are covered with a hard layer of abrasive. These discs wear relatively fast and often are not sufficiently elastic. Besides, they are expensive. Another type of elastic abrasive member is the composite abrasive member which consists of radially extending abrasive laminae. These composite abrasive members are also more expensive than rigid abrasive members and their elasticity decreases quickly as the abrading pressure increases because this forces the abrasive laminae against each other.

For this reason, it has already been attempted to embed the abrasive in a binder which is ultimately elastic rather than in a hard binder. Whereas these so-called elastic abrasive members can be manufactured more easily and at a lower cost than the above-mentioned elastic abrasive wheels, their cutting performance is extremely poor; this is due to the fact that the working pressure causes the individual particles to yield into the elastic matrix or to break out. The only measures which are known so far to avoid this are an increase of the ratio of abrasive to elastic binder or the use of a harder binder. In both cases, a sufficient elasticity is not obtained.

For the reasons stated above, endless abrasive belts having an adhered joint have been increasingly adopted for abrading purposes. The abrasive belts are trained around a backing pulley so that the elasticity of the support afforded by said pulley can be selected within certain limits by the use of a suitably elastic material for the pulley and, if desired, by the formation of grooves in the pulley. However, belt grinding too leaves much to be desired, particularly because profiles cannot be formed and because the behaviour varies greatly between a new belt and a worn belt as to the abrading performance and the roughness of the abraded surface.

Rigid abrading wheels are made from an easily flowable, particulate mixture, which comprises abrasive particles, binder, fillers and additives. In the processing of said material, it is essential to avoid an agglomeration of abrasive particles because any agglomerates would act like much larger particles in the finished abrasive members. Such large particles may not be permissible for the intended use and particularly in precision grinding work will result in workpieces which must be rejected because they are formed with grooves.

Contrary to this experience, research work and practical tests carried out by manufacturers of abrasive members have shown that such conglomerates of rigidly bonded abrasive particles in an elastic matrix combine very good abrasive properties with a high elasticity. The spaced apart conglomerates virtually float in the elastic binder so that the elasticity of the latter is preserved.

The elastic abrasive member according to the invention comprises a matrix, and a

multiplicity of conglomerates of abrasive particles embedded in said matrix, said matrix comprising an elastic binder which produces an elastic bond between said conglomerates, each of said conglomerates comprising a multiplicity of said abrasive particles and a binder which produces between said particles of said conglomerates a bond which is more rigid than said elastic bond.

For a given proportion of abrasive particles, an abrasive member according to the invention, having hard conglomerates of abrasive particles in an elastic matrix has a higher macro-elasticity, a much better cutting performance and a longer life than an elastic abrasive member of known type, having individual particles in an elastic binder.

Because of the roughness of the surface, the conglomerates are excellently retained by the elastic binder. These conglomerates may have any desired form; for instance, they may be polygonal, round or roll-shaped. They may be provided with a covering having a high affinity to the elastic matrix. In any case, a high bond strength is ensured by the rough surface and by the bond between the covering and the matrix.

It is desirable to bond the conglomerates so that they are porous, whereas the elastic matrix may be non-porous or porous.

In abrasive wheels up to 200 millimetres in diameter, the conglomerates of abrasive particles provided according to the invention may be 2—6 millimetres in diameter. In wheels up to 400 millimetres in diameter, the conglomerates of abrasive particles may be 4—10 millimetres in diameter. The abrasive particles used in the conglomerates may comprise corundum, silicon carbide or the like. The elastic binder may comprise, e.g., soft rubber, elastic polyurethanes, plasticised epoxide resins, soft polyvinylchloride and others.

In view of the state of the art and practical tests, it is considered that the provision of conglomerates of hard-bonded individual particles in an elastic binder is the only way which enables the provision of an elastic abrasive member having a good cutting performance.

In addition to the abrasive particles and binder, the conglomerates of abrasive particles may contain known additives for abrasive materials and other substances, such as iron pyrites, cryolite, potassium fluoborate. These substances may also be incorporated in the elastic matrix of the wheel in order to promote the abrading operation.

Hence, the abrasive members of the invention comprise a matrix which consists of rubber-elastic material and in which the abrasive particles are contained in the form of conglomerates, in which the particles are held together by a binder which produces a more rigid bond than the rubber-elastic matrix.

The reference to the use of a hard binder in the conglomerates of particles means that this binder when cured or vulcanised or set gives a more rigid bond than th elastic matrix of the finished abrasive member. Examples of binders which may be used in the conglomerates are the binders known in the industry for abrasive materials, such as ceramic binders, hydrated binders, natural resin binders, synthetic resin binders, and others.

The abrasive members of the invention are suitably fixed to a support. In grinding wheels of the usual shape, that support permits mounting of the abrasive members on a machine. The abrasive member may be applied to a flexible support, e.g., of vulcanised fibre, cotton twill, or the like.

The abrasive members according to the invention are eminently suitable for abrading operations which have previously been performed with felt wheels, composite abrasive members, and abrasive belts. They have considerable advantages over the above-mentioned conventional abrasive materials. For instance, they can be profiled excellently; their elasticity can be reproducibly selected within a much wider range; the cutting performance (cutting power and total cutting capacity) is increased; the surface roughness of the workpiece can be predetermined and remains constant; the abrasive member may be used for wet and dry abrading operations; the deposition of smearing workpiece material on the abrasive member is reduced; and glazing is avoided.

WHAT WE CLAIM IS:—

1. An elastic abrasive member, which comprises a matrix, and a multiplicity of conglomerates of abrasive particles embedded in said matrix, said matrix comprising an elastic binder which produces an elastic bond between said conglomerates, each of said conglomerates comprising a multiplicity of said abrasive particles and a binder which produces between said particles of said conglomerates a bond which is more rigid than said elastic bond.

2. An elastic abrasive member as claimed in Claim 1, in which the binder in said conglomerates is a ceramic binder.

3. An elastic abrasive member as claimed in Claim 1, in which the binder in said conglomerates is a hydrated binder.

4. An elastic abrasive member as claimed in Claim 1, 2 or 3, in which said conglomerates are 2 to 10 millimetres in diameter.

5. An elastic abrasive member as claimed in any one of Claims 1 to 4, in

which each of said conglomerates has a covering of a material which has a high affinity to said matrix.

6. An elastic abrasive member as claimed in any one of the preceding claims, in which each of said conglomerates is porous.

7. An elastic abrasive member as claimed in any one of the preceding claims, in which said matrix is non-porous.

8. An elastic abrasive member as claimed in any one of Claims 1 to 6, in which said matrix is porous.

9. An elastic abrasive member as claimed in any one of the preceding claims, in which said matrix is bonded to a support.

10. An elastic abrasive member according to Claim 1 substantially as hereinbefore described.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1971.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.